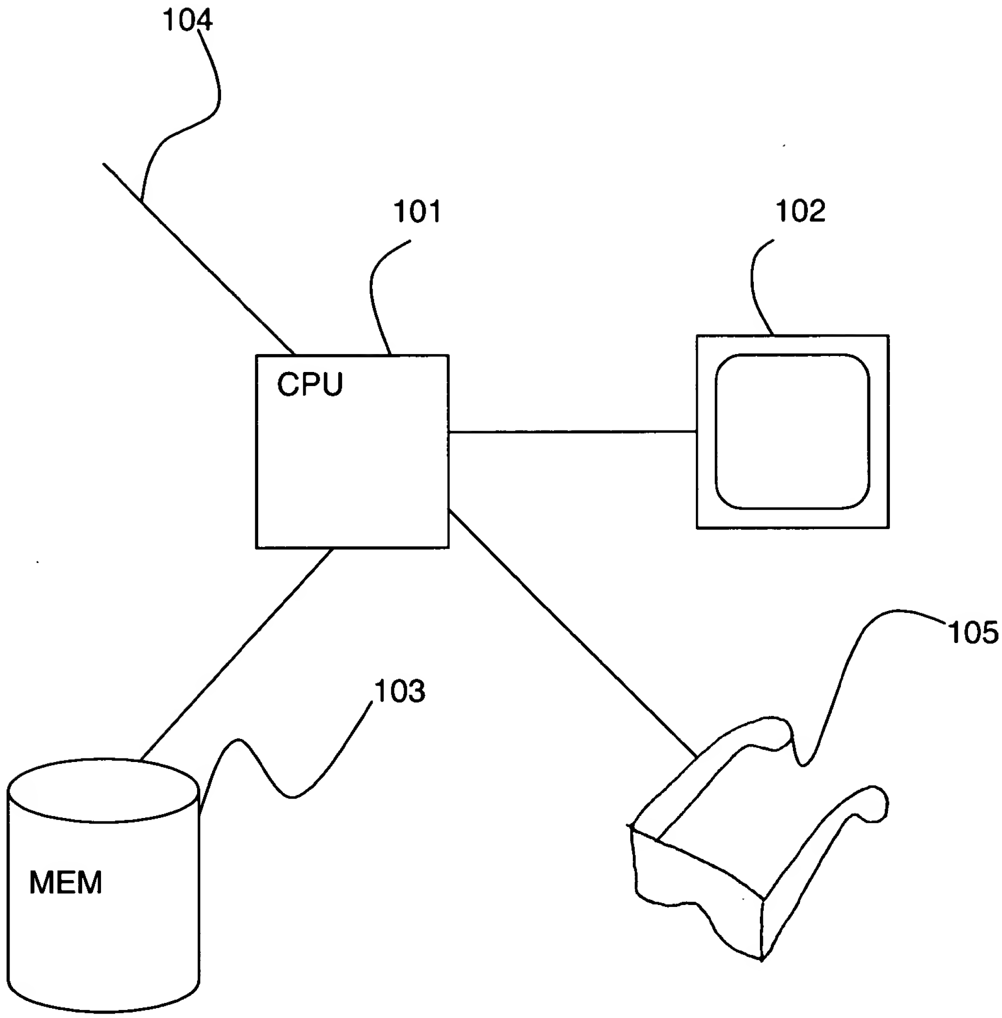

Fig. 1

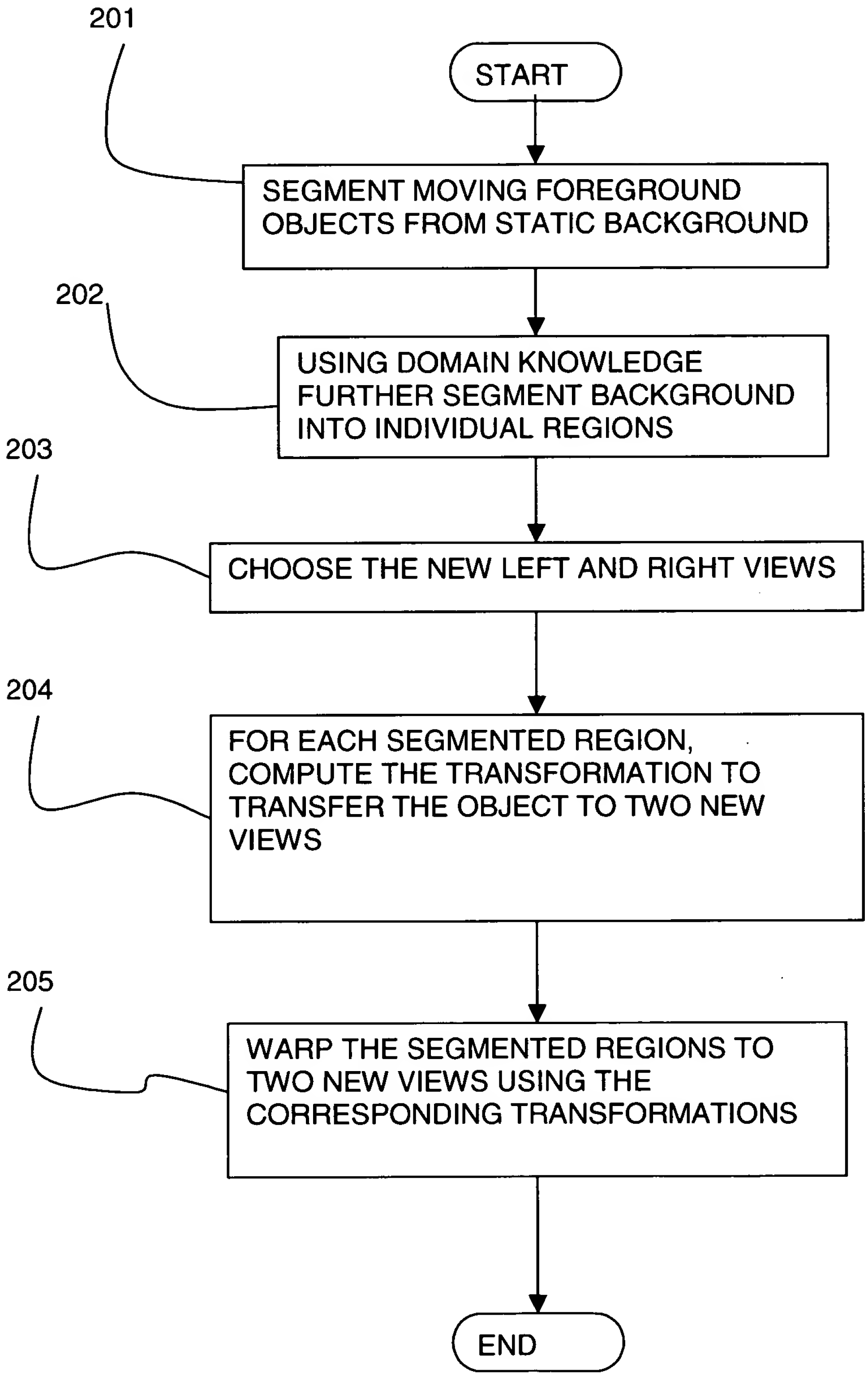
201
START
SEGMENT MOVING FOREGROUND OBJECTS FROM STATIC BACKGROUND
202
USING DOMAIN KNOWLEDGE FURTHER SEGMENT BACKGROUND INTO INDIVIDUAL REGIONS
203
CHOOSE THE NEW LEFT AND RIGHT VIEWS
204
FOR EACH SEGMENTED REGION, COMPUTE THE TRANSFORMATION TO TRANSFER THE OBJECT TO TWO NEW VIEWS
205
WARP THE SEGMENTED REGIONS TO TWO NEW VIEWS USING THE CORRESPONDING TRANSFORMATIONS
END

Fig. 2

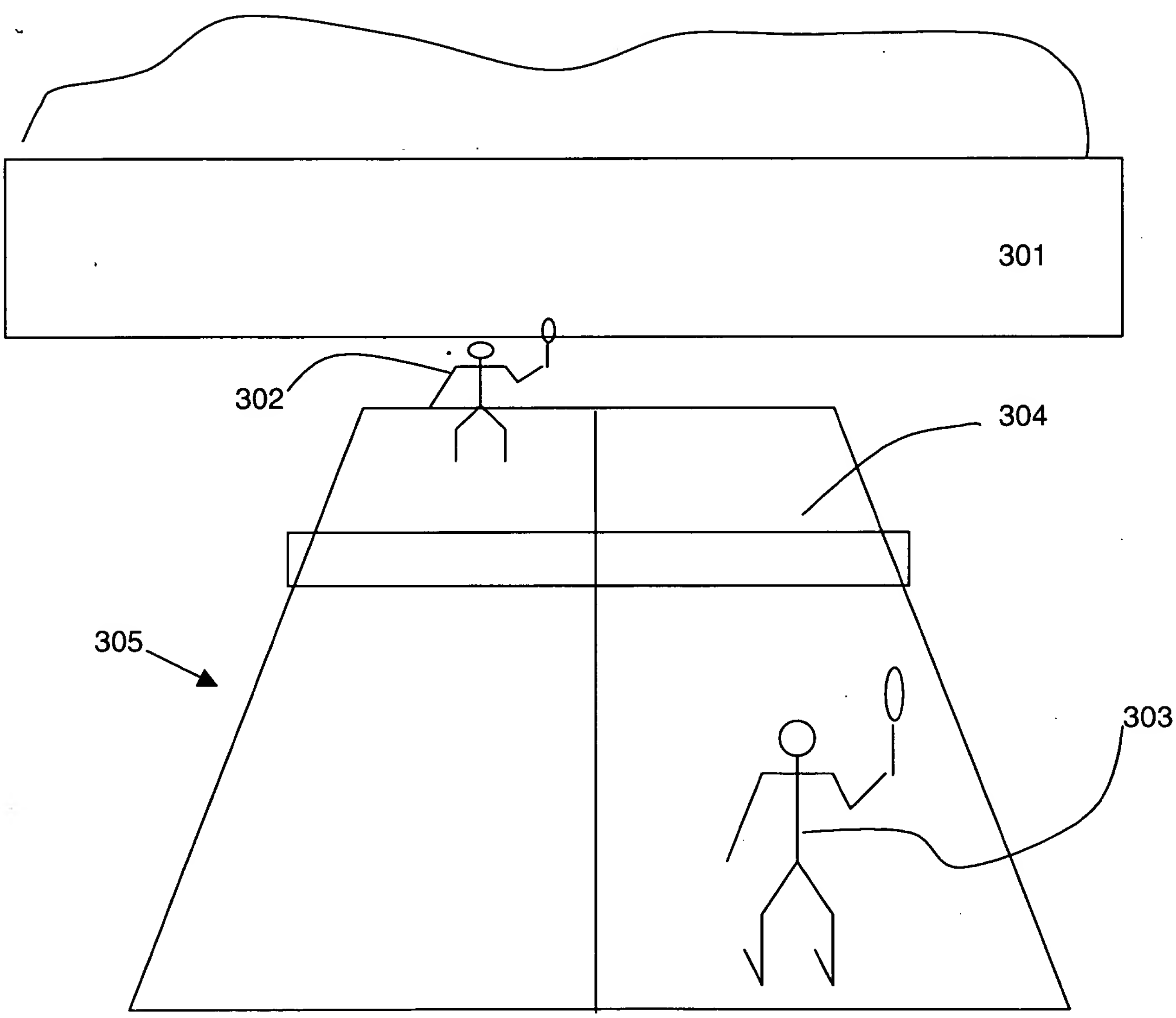

Fig. 3

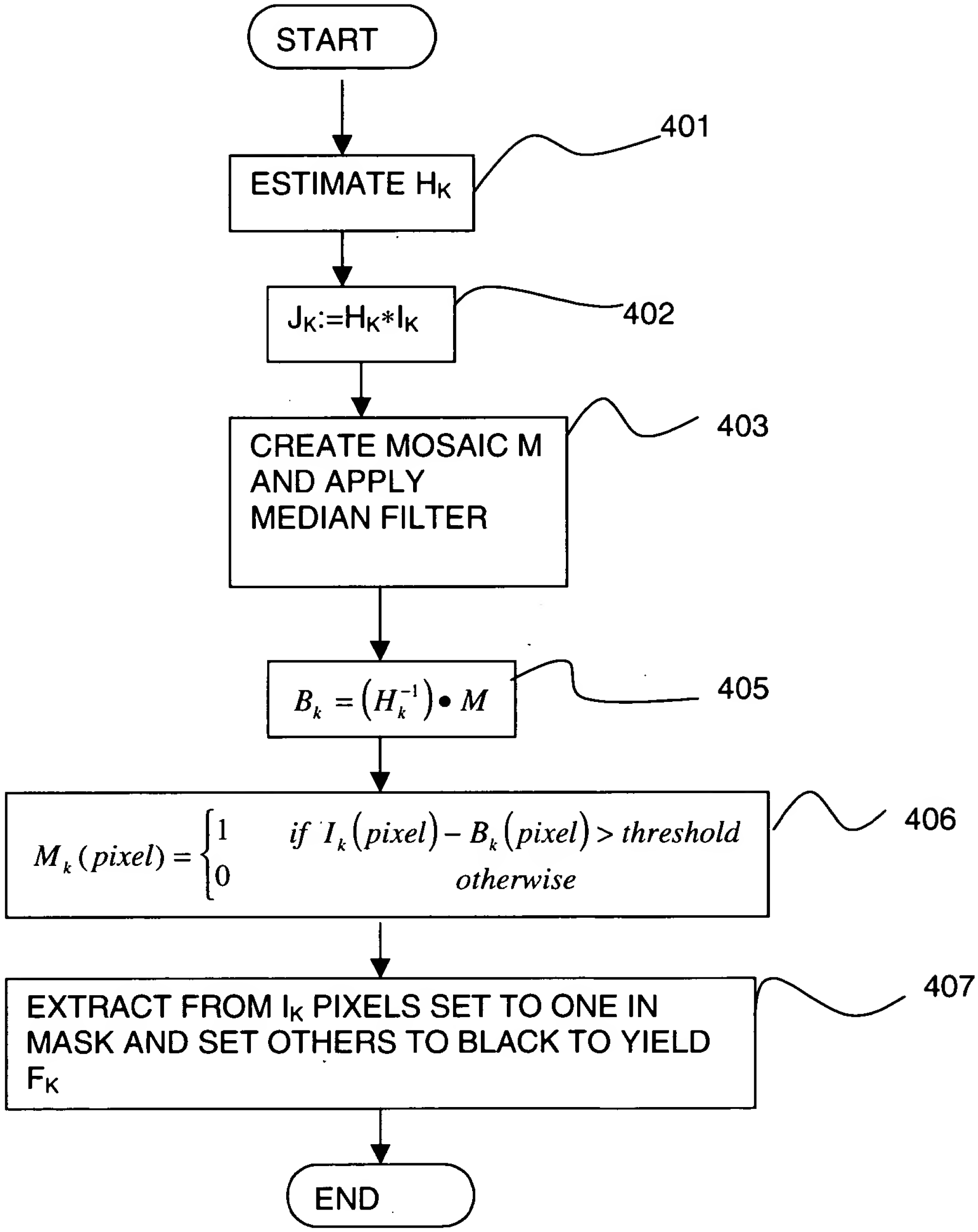
START
ESTIMATE H_K
401
$J_K:=H_K*I_K$
402
CREATE MOSAIC M AND APPLY MEDIAN FILTER
403
$B_k = \left(H_k^{-1}\right) \bullet M$
405
$M_k(pixel) = \begin{cases} 1 & \text{if } I_k(pixel) - B_k(pixel) > threshold \\ 0 & otherwise \end{cases}$
406
EXTRACT FROM I_K PIXELS SET TO ONE IN MASK AND SET OTHERS TO BLACK TO YIELD F_K
407
END

Fig. 4

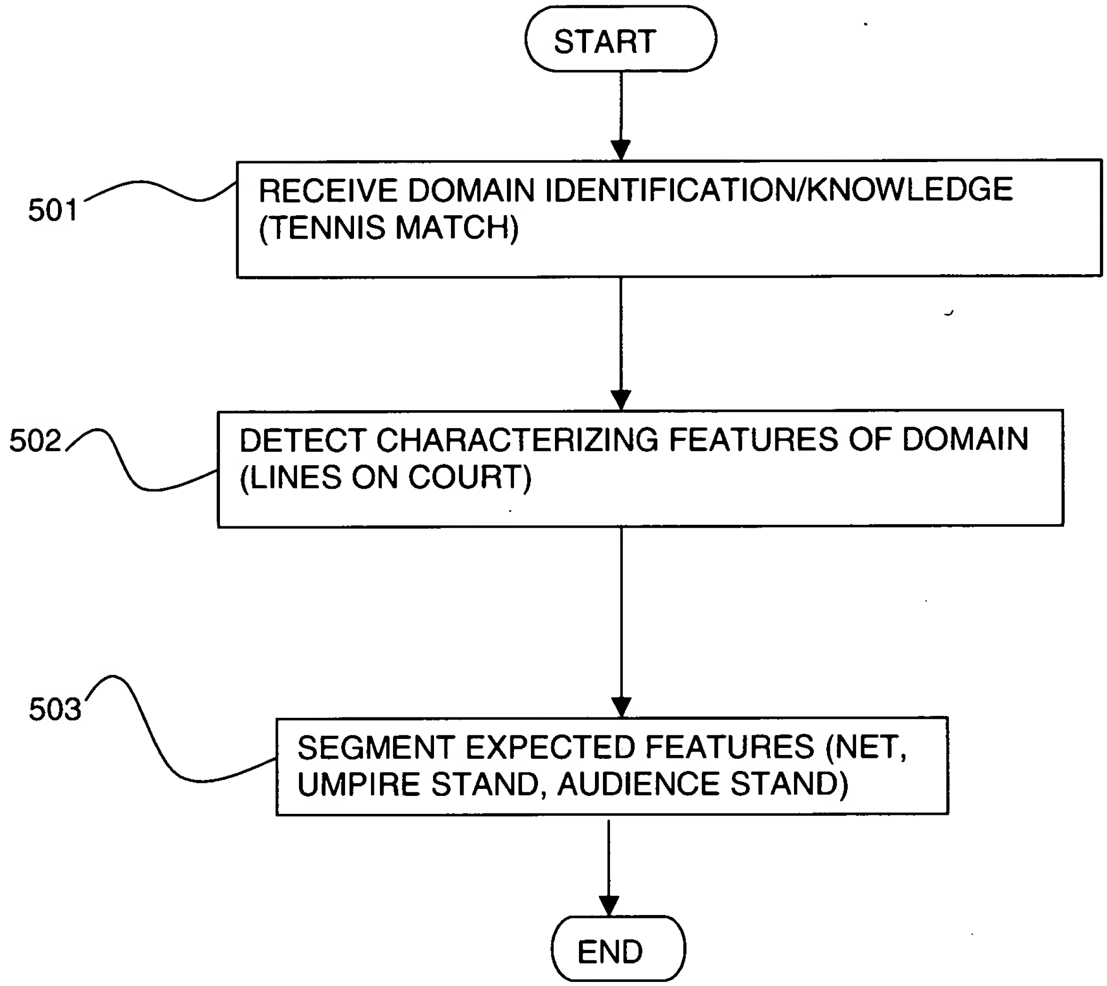
START
501
RECEIVE DOMAIN IDENTIFICATION/KNOWLEDGE (TENNIS MATCH)
502
DETECT CHARACTERIZING FEATURES OF DOMAIN (LINES ON COURT)
503
SEGMENT EXPECTED FEATURES (NET, UMPIRE STAND, AUDIENCE STAND)
END

FIG. 5

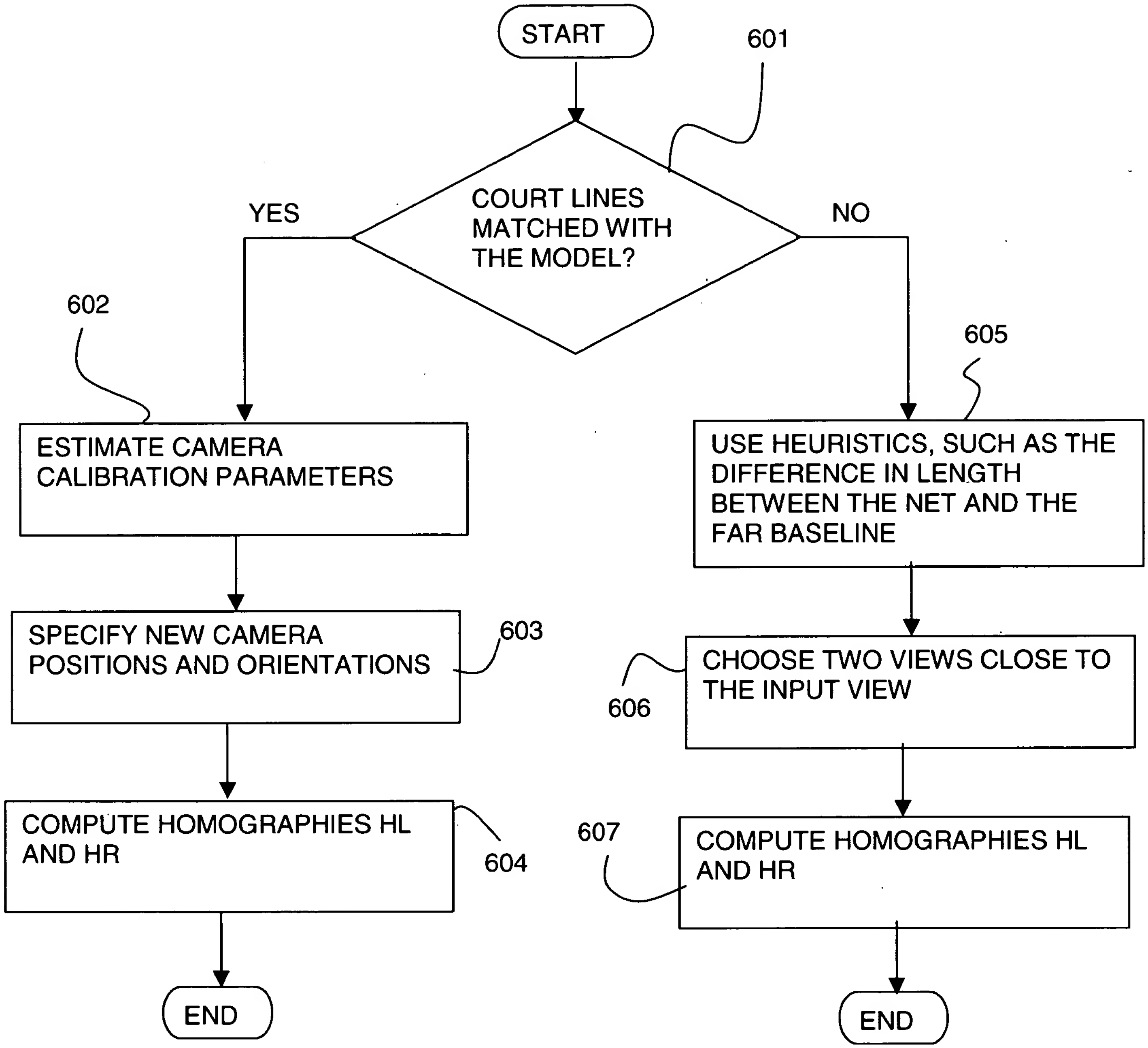
START
601
COURT LINES MATCHED WITH THE MODEL?
YES
NO
602
ESTIMATE CAMERA CALIBRATION PARAMETERS
603
SPECIFY NEW CAMERA POSITIONS AND ORIENTATIONS
604
COMPUTE HOMOGRAPHIES HL AND HR
END
605
USE HEURISTICS, SUCH AS THE DIFFERENCE IN LENGTH BETWEEN THE NET AND THE FAR BASELINE
606
CHOOSE TWO VIEWS CLOSE TO THE INPUT VIEW
607
COMPUTE HOMOGRAPHIES HL AND HR
END

FIG. 6

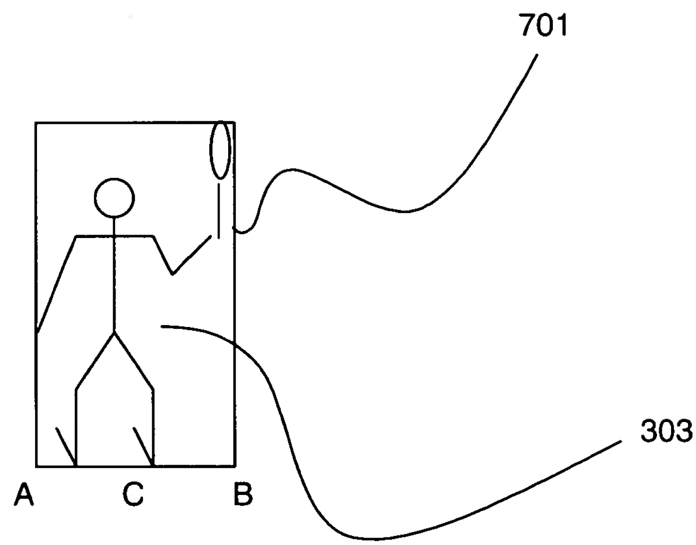

FIG. 7

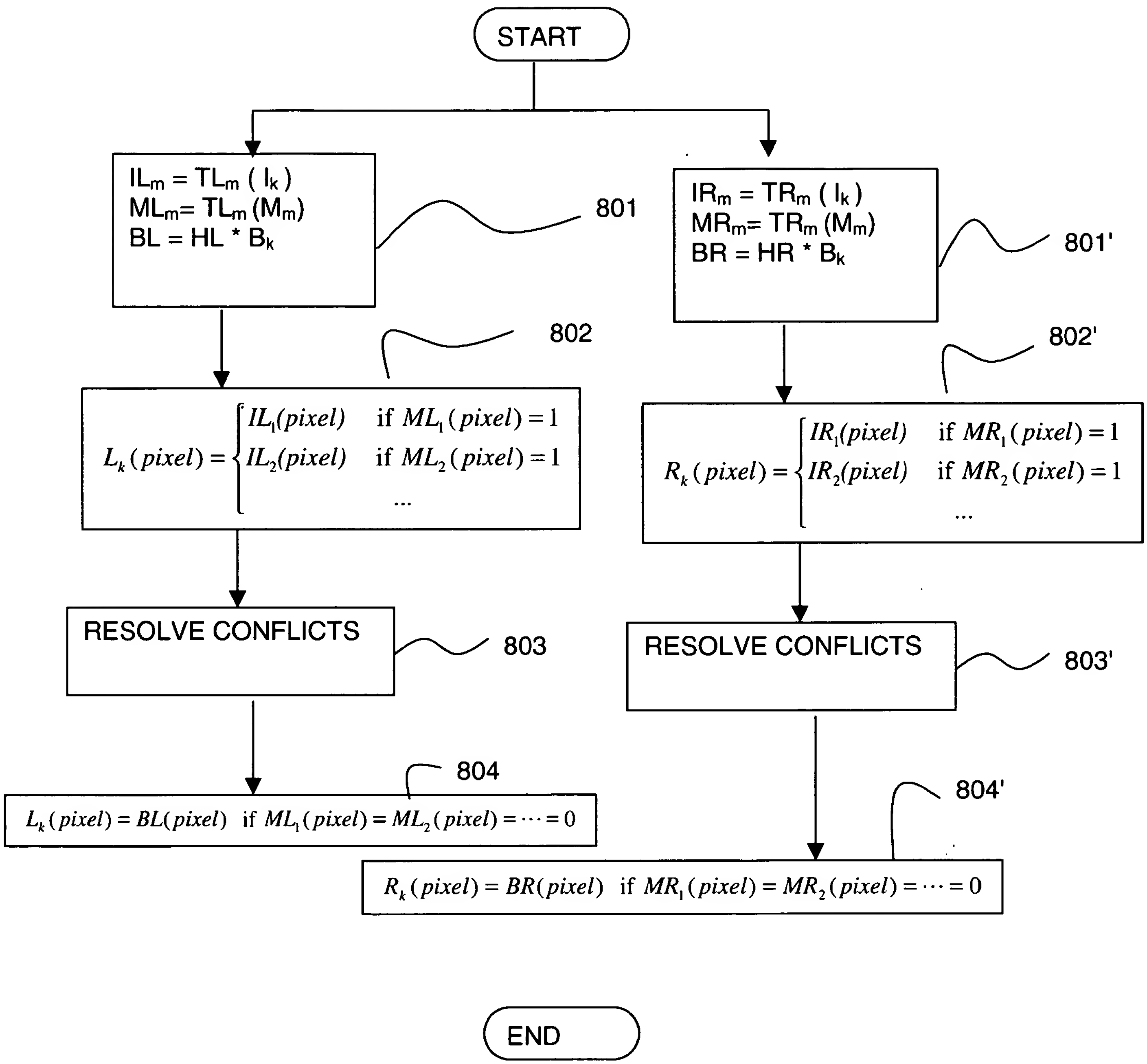
START
$IL_m = TL_m(I_k)$
$ML_m = TL_m(M_m)$
$BL = HL * B_k$
801
$IR_m = TR_m(I_k)$
$MR_m = TR_m(M_m)$
$BR = HR * B_k$
801'
802
$L_k(pixel) = \begin{cases} IL_1(pixel) & \text{if } ML_1(pixel) = 1 \\ IL_2(pixel) & \text{if } ML_2(pixel) = 1 \\ \ldots \end{cases}$
802'
$R_k(pixel) = \begin{cases} IR_1(pixel) & \text{if } MR_1(pixel) = 1 \\ IR_2(pixel) & \text{if } MR_2(pixel) = 1 \\ \ldots \end{cases}$
RESOLVE CONFLICTS
803
RESOLVE CONFLICTS
803'
804
$L_k(pixel) = BL(pixel) \text{ if } ML_1(pixel) = ML_2(pixel) = \cdots = 0$
804'
$R_k(pixel) = BR(pixel) \text{ if } MR_1(pixel) = MR_2(pixel) = \cdots = 0$
END

FIG. 8

FIG. 9

$$\left(\frac{h_{11}x+h_{12}y+h_{13}}{h_{31}x+h_{32}y+h_{33}},\frac{h_{21}x+h_{22}y+h_{23}}{h_{31}x+h_{32}y+h_{33}}\right) \tag{1}$$

$$\mathbf{HL}=\begin{pmatrix}1 & s_L & d_L\\ 0 & 1 & 0\\ 0 & 0 & 1\end{pmatrix} \tag{2}$$

$$\mathbf{HR}=\begin{pmatrix}1 & s_R & d_R\\ 0 & 1 & 0\\ 0 & 0 & 1\end{pmatrix} \tag{3}$$

$$(s_L-s_R)y+d_L-d_R \tag{4}$$

$$\mathbf{TL}=\begin{pmatrix}s & 0 & \Delta_x\\ 0 & s & \Delta_y\\ 0 & 0 & 1\end{pmatrix} \tag{5}$$

A=(Ax, Ay) (6)

B=(Bx, By) (7)

C=(Cx, Cy) (8)

A'=(A'x, A'y) (9)

B'=(B'x, B'y) (10)

C'=(C'x, C'y) (11)

FIG. 10

$$s = \frac{|A'x - B'x|}{|Ax - Bx|} \qquad \Delta_x = C'x - s \cdot Cx \qquad \Delta_y = C'y - s \cdot Cy \tag{12}$$

$$\frac{s_L y_1 + d_L}{s_L y_2 + d_L} = \frac{w_1}{w_2} \tag{13}$$

$$\begin{gathered} s_L(y_1 w_2 - y_2 w_1) + d_L(w_2 - w_1) = 0 \\ s_L y_B + d_L = d_{MAX} \end{gathered} \tag{14}$$

A”=(A”x, A”y) (15)

B”=(B”x, B”y) (16)

C”=(C”x, C”y) (17)

$$\mathbf{TR} = \begin{pmatrix} s'' & 0 & \Delta''_x \\ 0 & s'' & \Delta''_y \\ 0 & 0 & 1 \end{pmatrix} \tag{18}$$

FIG. 11

$$s''=\frac{|A''x-B''x|}{|Ax-Bx|} \qquad \Delta''_x=C''x-s''\cdot Cx \qquad \Delta''_y=C''y-s''\cdot Cy \tag{19}$$

$$vp_1=([sx_{11} \quad sy_{11} \quad 1]\times[ex_{11} \quad ey_{11} \quad 1])\times([sx_{12} \quad sy_{12} \quad 1]\times[ex_{12} \quad ey_{12} \quad 1]) \tag{20}$$

$$vp_2=([sx_{21} \quad sy_{21} \quad 1]\times[ex_{21} \quad ey_{21} \quad 1])\times([sx_{22} \quad sy_{22} \quad 1]\times[ex_{22} \quad ey_{22} \quad 1]) \tag{21}$$

$$a\times b \tag{22}$$

$$H_a=\begin{bmatrix}1&0&0\\0&1&0\\h_1&h_2&1\end{bmatrix} \quad where \quad \begin{bmatrix}h_1\\h_2\end{bmatrix}=\begin{bmatrix}x_1&y_1\\x_2&y_2\end{bmatrix}^{-1}\begin{bmatrix}-w_1\\-w_2\end{bmatrix} \tag{23}$$

$$p_i=[px_i \quad py_i] \tag{24}$$

$$p_i'=\left[\frac{px_i}{h_1px_i+h_2py_i+1} \quad \frac{py_i}{h_1px_i+h_2py_i+1}\right] \tag{25}$$

FIG. 12

$$H_b = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & 1 \end{bmatrix} \quad where \quad \begin{bmatrix} qx_1 & qy_1 & 1 & 0 & 0 & 0 & -px'_1 \cdot qx_1 & -px'_1 \cdot qy_1 \\ qx_2 & qy_2 & 1 & 0 & 0 & 0 & -px'_2 \cdot qx_2 & -px'_2 \cdot qy_2 \\ qx_3 & qy_3 & 1 & 0 & 0 & 0 & -px'_3 \cdot qx_3 & -px'_3 \cdot qy_3 \\ qx_4 & qy_4 & 1 & 0 & 0 & 0 & -px'_4 \cdot qx_4 & -px'_4 \cdot qy_4 \\ . & . & . & . & . & . & . & . \\ 0 & 0 & 0 & qx_1 & qy_1 & 1 & -py'_1 \cdot qx_1 & -py'_1 \cdot qy_1 \\ 0 & 0 & 0 & qx_2 & qy_2 & 1 & -py'_2 \cdot qx_2 & -py'_2 \cdot qy_2 \\ 0 & 0 & 0 & qx_3 & qy_3 & 1 & -py'_3 \cdot qx_3 & -py'_3 \cdot qy_3 \\ 0 & 0 & 0 & qx_4 & qy_4 & 1 & -py'_4 \cdot qx_4 & -py'_4 \cdot qy_4 \\ . & . & . & . & . & . & . & . \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \\ g \\ h \end{bmatrix} = \begin{bmatrix} -px'_1 \\ -px'_2 \\ -px'_3 \\ -px'_4 \\ . \\ -py'_1 \\ -py'_2 \\ -py'_3 \\ -py'_4 \\ . \end{bmatrix} \qquad (26)$$

$$q_i = [qx_i \quad qy_i] \qquad (27)$$

$$q_i' = \begin{bmatrix} \dfrac{a \cdot qx_i + b \cdot qy_i + c}{g \cdot qx_i + h \cdot qy_i + 1} & \dfrac{e \cdot qx_i + f \cdot qy_i + g}{g \cdot qx_i + h \cdot qy_i + 1} \end{bmatrix} \qquad (28)$$

$$e_{12} = ([px_a' \quad py_a' \quad 1] \times [qx_a' \quad qy_a' \quad 1]) \times ([px_b' \quad py_b' \quad 1] \times [qx_b' \quad qy_b' \quad 1]) \qquad (29)$$

$$e_{12}' = H_a * \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \qquad (30)$$

$$e_{22}' = (1 + w) \cdot e_{12} - w \cdot e_{12}' \qquad (31)$$

FIG. 13

$$r_i' = ([px_i' \quad py_i' \quad 1] \times e_{12}') \times ([qx_i' \quad qy_i' \quad 1] \times e_{22}') \qquad (32)$$

$$r_i = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} H_a^{-1} \begin{bmatrix} 1 & 0 & d \cdot ex_{12}' \\ 0 & 1 & d \cdot ey_{12}' \\ 0 & 0 & 1+d \end{bmatrix} r_i' \qquad (33)$$